3J CONSULTING

CIVIL ENGINEERING | WATER RESOURCES | COMMUNITY PLANNING

PRELIMINARY STORMWATER MANAGEMENT PLAN

Crestview Green Planned Unit Development
Newberg, OR 97132

January 14, 2022

Prepared For:

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Project No: 21701
KEF/PJP

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DESIGNER'S CERTIFICATION & STATEMENT

I hereby certify that this Stormwater Management Plan for the Crestview Green Planned Unit Development project has been prepared by me or under my supervision and meets minimum standards of the City of Newberg, Oregon Department of Transportation, and normal standards of engineering practice. I hereby acknowledge and agree that the jurisdiction does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities designed by me.

EXECUTIVE SUMMARY

The Crestview Green Planned Unit Development is proposed at 4821 E Portland Road in the City of Newberg, Yamhill County, Oregon (tax lots 3S2W16 0900 & 01000). The project proposes a mixture of single-family dwellings, attached single-family dwellings, a multi-family building, roadways, other hardscaping, landscaping, and utility improvements. The project also proposes frontage improvements along NE Benjamin Road and Highway 99W. The property has an area of 10.58 ac; however, the total area of analysis (project site) is approximately 11.88 ac to include frontage improvements. The project will involve disturbing 61,132 sf of existing impervious area and is expected to result in 309,360 sf of post-developed impervious area. The project is within the jurisdictions of the City of Newberg and the Oregon Department of Transportation (ODOT).

Stormwater runoff from post-developed impervious areas will drain to proposed storm drain systems, which consist of stormwater best management practices (BMP), prior to discharging offsite. All runoff eventually outfalls to Spring Brook to the east of the project site. The proposed BMPs include:

- Water Quality Facilities
  - Post-developed impervious areas associated with the multi-family building will be treated via a BayFilter Manhole (Proprietary Treatment System) equipped with two (2) BayFilter 545 media cartridges.
  - Post-developed impervious areas associated with the single-family dwellings and Highway 99W frontage improvements will be treated via a Vegetated Swale (19-ft bottom width, 120-ft length, 0.5% slope).
  - Pretreatment Manholes are proposed upstream of both water quality BMPs.
- Detention Facilities
  - The post-developed basin associated with the multi-family building will be managed via a Flow Control Manhole, which will detain flow within the upstream storm drain system. This system collects runoff from area only in City jurisdiction and will therefore adhere to City flow control criteria.
  - The post-developed basin associated with the single-family dwellings will be managed via a Detention Pond and Flow Control Manhole. This basin also collects runoff from ODOT right-of-way and will therefore adhere to flow control criteria for both the City and ODOT.

Results of hydraulic analyses for the proposed onsite storm drain systems will be provided in the Final Stormwater Management Plan.

A Downstream Analysis was not performed due to the implementation of onsite detention facilities; A Certificate of Investigation is attached.

An Operations & Maintenance Plan will be prepared in conjunction with the Final Stormwater Management Plan.

The purpose of this report is to accomplish the following:

- Describe existing and post-developed basins and drainage;
- Describe the design and analysis of the proposed stormwater management facilities; and,
- Demonstrate compliance with City of Newberg *Public Works Design and Construction Standards* (2015) and ODOT's *Hydraulic Design Manual* (2014).

PROJECT DESCRIPTION

The Crestview Green Planned Unit Development is proposed at 4821 E Portland Road in the City of Newberg, Yamhill County, Oregon (tax lots 3S2W16 0900 & 01000). The project proposes a mixture of single-family dwellings, attached single-family dwellings, a multi-family building, roadways, other hardscaping, landscaping, and utility improvements. The project also proposes frontage improvements along NE Benjamin Road and Highway 99W.

The project is within the jurisdictions of the City of Newberg and the Oregon Department of Transportation (ODOT). The design criteria for stormwater management facilities will be per the City's *Public Works Design & Construction Standards* (2015) and ODOT's *Hydraulics Design Manual* (2014) where applicable.

The property has an area of 10.58 ac; however, the total area of analysis (project site) is approximately 11.88 ac to include frontage improvements. An existing wetland is located in the northeast corner of the project site.

The project will involve disturbing 61,132 sf of existing impervious area and is expected to result in 309,360 sf of post-developed impervious area. In existing conditions, stormwater runoff discharges offsite at four (4) locations. In post-developed conditions, one discharge location will be eliminated to mitigate direct runoff from impervious areas to Spring Brook to the east. Post-developed impervious areas will not discharge to the existing wetland.

Stormwater runoff from post-developed impervious areas will drain to proposed storm drain systems, which consists of proposed stormwater best management practices prior to discharging offsite. All runoff eventually outfalls to Spring Brook to the east of the project site.

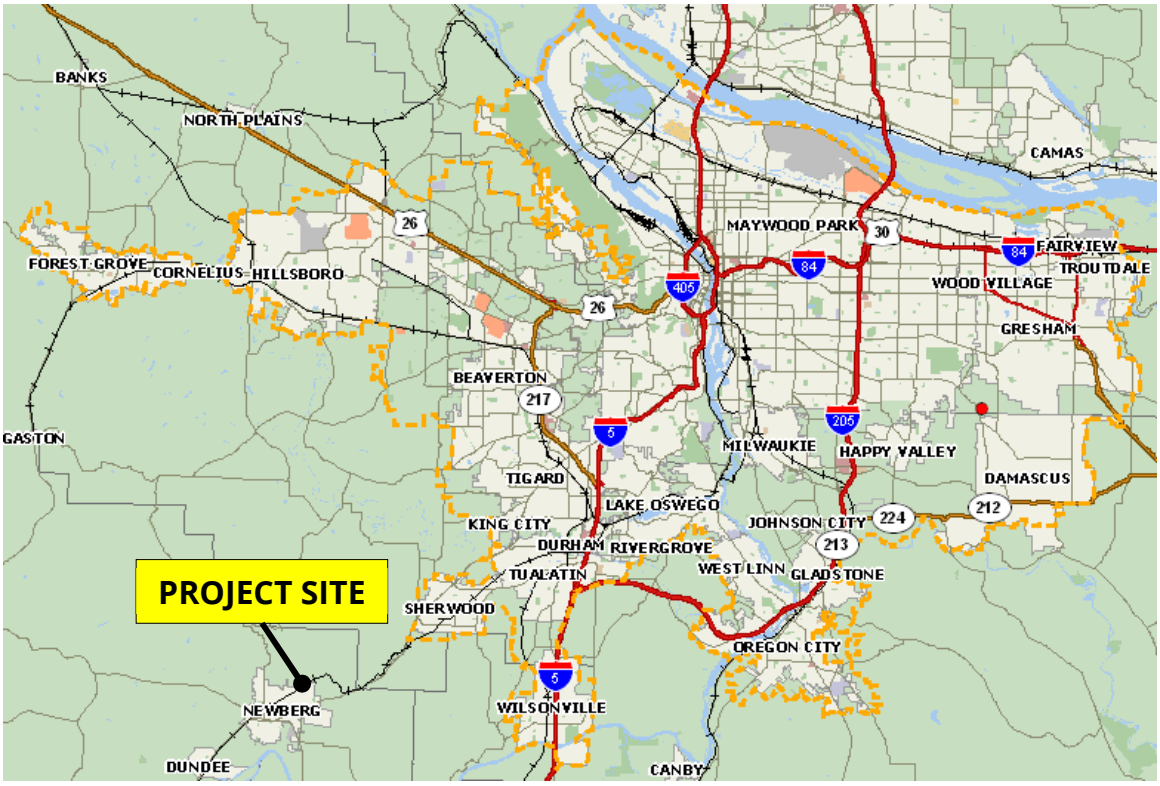


Figure 1 - Vicinity Map

Figure 2 - Site Location

EXISTING CONDITIONS

Site

The existing site consists of two single-family residences, driveways, and landscaped areas. All onsite impervious will be demolished. The project also proposes frontage improvements along Highway 99W (E Portland Road) to the south and Benjamin Road to east.

Soils & Infiltration

Per USDA Web Soil Survey of Yamhill County, soils underlying the project site consist primary of Woodburn Silt Loam with areas to be disturbed for frontage improvements along Highway 99W underlain with Amity Silt Loam. Both of these soils correspond to hydrologic soil group C.

The site to the west, Crestview Crossing, is currently being constructed. This development is underlain with Woodburn Silt Loam with onsite elevations comparable to this project site. Infiltration rates were negligible for Crestview Crossing and are expected to be negligible for this project due to similar soils and topography. As a result, onsite stormwater management facilities will be designed assuming no onsite infiltration.

Flood Map

The site is located within Zone X (unshaded) per flood insurance rate map (FIRM) community-panel number 41071C0235D (See Technical Appendix: Exhibits – FIRMette). FEMA's definition of Zone X (un-shaded) is an area of minimal flood hazard.

Drainage

In existing conditions, the site drains to four (4) discharge locations (See Technical Appendix: Exhibits – Existing Conditions).

- Discharge Location #1 – The western portion of the site drains from north to south to a ditch along the northern side of Highway 99W; the ditch outlets to a 12" culvert that conveys flow across Highway 99W to a ditch (on the southern side of the freeway) that flows easterly for approximately 250 ft and discharges to Spring Brook.
- Discharge Location #2 – The central portion of the site drains from north to south to a ditch that outlets to a 12" culvert near the southeastern corner of the project site; the culvert crosses Benjamin Road and discharges to Spring Brook upstream of the road-stream culvert crossing of Highway 99W. Runoff from frontage improvements along Highway 99W will be diverted to this discharge location in post-developed conditions. Therefore, these areas will be included in the hydrologic analysis of Discharge Location #2 for predeveloped conditions since these areas' runoff will confluence with runoff from the property almost immediately in Spring Brook.
- Discharge Location #3 – The eastern portion of the site drains west to east directly onto Benjamin Road and discharges to Spring Brook.
- Discharge Location #4 – The smallest portion of the site drains from west to east to an existing wetland in the northeastern corner of the project site.

Upstream Basins

There are minor runoff areas to the north of the project site that drain onto the contributing basins for Discharge Locations #1, #2, and #4. These areas consist of forested or landscaping. Runoff is expected to be negligible from these upstream basins; therefore, their runoff quantities were not evaluated and are not included in this report.

Basin Areas

Table 1 outlines the contributing basin areas for each discharge location in existing conditions (See Technical Appendix: Exhibits – Existing Conditions).

Discharge Location	Contributing Basin Areas (ac)		
	Impervious	Pervious	Total
#1	0.13	3.48	3.61
#2	0.99[(1)]	3.79[(1)]	4.78[(1)]
#3	0.18	1.85	2.04
#4	0.10	1.35	1.45
Total	1.40	10.47	11.88

Table 1 – Basin Areas – Existing Conditions

[(1)]Contains areas to be disturbed for frontage improvements along Highway 99W

It's important to note that existing impervious area has been disregarded in sizing stormwater management facilities at this stage of design, for conservativeness.

POST-DEVELOPED CONDITIONS

Site

In post-developed conditions, the project proposes a mixture of single-family dwellings, attached single-family dwellings, a multi-family development, roadways, other hardscaping, landscaping, and utility improvements. Due to the amount of net new impervious area generated, stormwater management facilities are also proposed and are detailed in a later section. The proposed Highway 99W frontage improvements, within

ODOT right-of-way (ROW), will drain to a storm drain line that will ultimately discharge to onsite (private) stormwater facilities.

Drainage

In post-developed conditions, most onsite runoff will be directed to Discharge Locations #1 & #2 (See Technical Appendix: Exhibits – Post-Developed Conditions).

- Discharge Location #1 – The proposed multi-family development in the southwestern portion of the site include a proposed storm drain system which will connect to the existing 12" culvert that conveys flow across Highway 99W to the southern side of the freeway.
- Discharge Location #2 – The largest portion of the post-developed project site will drain to a proposed storm drain system that leaves the site at this discharge location. The outlet pipe will connect to the existing 48" culvert at the road-stream crossing of Highway 99W and Spring Brook. Post-developed areas associated with the Highway 99W frontage improvements outfall to this discharge location.
- Discharge Location #3 – This is discharge location is eliminated to mitigate direct runoff from post-developed impervious area to Spring Brook to the east. Onsite areas that drained to this discharge location in existing conditions will be diverted to Discharge Location #2.
- Discharge Location #4 – Development will not occur within the wetland buffer near this discharge location. Onsite areas that drained to the wetland in existing conditions will be diverted to Discharge Location #2.

Basin Areas

Table 2 outlines the contributing basin areas for each discharge location in post-developed conditions (See Technical Appendix: Exhibits – Post-Developed Conditions). In accordance with the D&C Standards, it is assumed that 2,877 sf of impervious area is proposed for each single-family residential lot with the exception of lots whose size is less than 2,877 sf. For these smaller lots, it is assumed that the area bound by the setback lines is completely impervious in post-developed conditions.

Discharge Location	Contributing Basin Areas (ac)		
	Impervious	Pervious	Total
#1	0.53	0.56	1.09
#2[(1)(2)]	6.57[(2)]	4.03[(1)(2)]	10.60[(1)(2)]
#3	0.00	0.00	0.00
#4	0.00	0.19	0.19
Total	7.10	4.78	11.88

Table 2 – Basin Areas – Post-Developed Conditions

[(1)]Area contains detention pond area (21,175 sf)

[(2)]Consists of Highway 99W frontage improvements (ODOT ROW)

HYDROLOGIC ANALYSIS

Design Guidelines

The site is located within the jurisdictions of the City of Newberg and ODOT. As a result, design guidelines for this project reflect current City's *Public Works Design & Construction Standards* (D&C Standards; Aug 2015) and ODOT's *Hydraulic Design Manual* (ODOT Standards; Apr 2014).

Methodology & Software Used

Naturally occurring rainstorms dissipate over long periods of time. An effective way of estimating storm rainfall is by using the hydrograph method. In accordance with the D&C and ODOT Standards, the Santa Barbara Urban Hydrograph (SBUH) method was used to develop runoff rates. The computer software XPSTORM was used in modeling pre- and post-developed hydrologic response for all required design storm events.

Design Storms

The rainfall distribution to be used for this area is the design storm of 24-hour duration based on the standard Type 1A rainfall distribution. Table 3 shows total precipitation depths for the storm events used analysis, which were used as multipliers for the rainfall distribution.

Recurrence Interval (yr)	Precipitation Depth (in)
WQ[(1)]	1.00
42% of 2 [(2)]	1.05
50% of 2[(1)(3)]	1.25
2	2.50
10	3.50
25	4.00
50[(2)]	4.20

Table 3 - Design Storms

[(1)]City standard; [(2)]ODOT standard;
[(3)]ODOT water quality storm event

Curve Number

The runoff curve number (CN) is a parameter that is used to estimate runoff volumes. Contributing factors for CN include soil type, antecedent moisture condition, and land cover. CNs were selected from tables provided in the TR-55 manual (See Technical Appendix: Exhibits – Curve Number).

For predeveloped conditions, basin areas were modeled with a CN of 72, which corresponds to woods-grass combination cover in good condition for soil type C.

Post-developed impervious and pervious areas were modeled with CNs of 98 and 74, respectively. The latter corresponds to landscaped areas in good condition for soil type C.

Time of Concentration

Time of concentration (Tc) is the estimated time for runoff from the remotest point in a drainage basin to reach its outfall and is used to evaluate peak runoff rates. Predeveloped Tc's were evaluated using TR-55 methods and knowledge of basin slope, flowpath lengths, and local rainfall data (See Technical Appendix: Calculations – Time of Concentration).

Post-developed Tc's are assumed to be a conservative 5 minutes for all contributing areas.

Basin Runoff

Discharge Location #1

The contributing basin for Discharge Location #1 is within City jurisdiction and will adhere to the D&C Standards. Table 4 compares pre- and post-developed peak runoff rates for Discharge Location #1 (See Technical Appendix: Hydrographs). The following table (and Table 5 below) includes the peak runoff rate for the water quality design storm, which will be used to size water quality facilities in the next section.

Recurrence Interval (yr)	Peak Runoff Rates (cfs)		
	Predeveloped	Post-Developed	Change
WQ	-	0.11	-
50% of 2	0.02	0.14	+0.12
2	0.16	0.35	+0.19
10	0.59	0.57	-0.02
25	0.86	0.68	-0.18

Table 4 – Peak Runoff Rates – Discharge Location #1

Discharge Location #2

The contributing basin for Discharge Location #2 contains some areas with ODOT ROW; therefore, it must adhere to the D&C and ODOT Standards. Table 5 compares pre- and post-developed peak runoff rates for Discharge Location #2 (See Technical Appendix: Hydrographs).

Recurrence Interval (yr)	Peak Runoff Rates (cfs)		
	Predeveloped	Post-Developed	Change
42% of 2	0.01	1.43	+1.42
WQ[(1)] & 50% of 2	0.03	1.76	+1.73
2	0.21	4.06	+3.85
10	0.74	6.21	+5.47
25	1.07	7.33	+6.26
50	1.22	7.79	+6.57

Table 5 – Peak Runoff Rates – Discharge Location #2

[(1)]ODOT requires treatment of the peak flow from the 50% of 2-yr storm event.

Discharge Locations #3 & #4

Runoff rates were not determined for the contributing basins for discharge locations #3 & #4, because the contributing basins are either reduced or eliminated in post-developed conditions.

WATER QUALITY TREATMENT

Design Guidelines

Per the D&C Standards, projects that generate a net impervious area of 2,877 sf (or greater) or disturbs an acre or more require Best Management Practices (BMP) to treat the stormwater runoff for all net new impervious area created.

Per ODOT Standards, producing new impervious surface area or changing the total contributing impervious area require the implementation of treatment BMPs.

Per these guidelines, water quality BMPs are required for post-developed impervious areas outfalling to Discharge Locations 1 & 2.

LIDA Feasibility

Low Impact Development Approaches (LIDA) aims to conserve existing resources, minimize disturbance, minimize soil compaction, minimize imperviousness, and direct runoff from impervious areas onto pervious areas. LIDA should be implemented to the maximum extent practicable.

Discharge Location #1

Due to site constraints, grading constraints, and onsite infiltration infeasibility, LIDA cannot be implemented to treat contributing runoff to Discharge Location #1. As a result, runoff from these post-developed areas will be treated with a Proprietary Treatment System.

Discharge Location #2

Due to poor infiltrating soils, infiltration LIDA cannot be implemented to treat contributing runoff to Discharge Location #2. As a result, runoff from these post-developed areas will be treated with a Vegetated Swale.

Water Quality Storm

Per the D&C Standards, water quality BMPs shall be designed for a dry weather storm event totaling 1.0 inches of precipitation falling in 24 hours with an average storm return period of 96 hours. This standard will be applicable to the contributing basin for Discharge Location #1.

Per ODOT Standards, the water quality design storm for this project site is equivalent to 50% of the 2-yr storm depth, or 1.25 inches falling in 24 hours. This is a stricter standard and will be adhered to for the contributing basin to Discharge Location #2.

Peak (design) flows for these storm depths were determined via the SBUH method using an NRCS Type 1A rainfall distribution.

Water Quality Facilities

Discharge Location #1

As indicated in Table 4, the water quality design flow rate for the contributing basin to this discharge location was evaluated to be 0.11 cfs. The proposed Proprietary Treatment System is a BayFilter Manhole equipped with two (2) BF-545 media cartridges. The treatment capacity of this system is 0.20 cfs.

A pretreatment manhole is proposed upstream of the BayFilter Manhole. Per the City's Standard Drawing 413 (Water Quality), pretreatment manholes are sized for the 25-yr contributing peak flow with the sump volume sized at a rate of 20 cf / 1 cfs. For this discharge location, the 25-yr peak flow is 0.68 cfs, resulting in a required sump volume of 13.6 cf. Assuming a 60" manhole diameter, the required depth is evaluated to be 8.3", which will be proposed at the minimum 36" per the standard detail.

Discharge Location #2

As indicated in Table 5, the water quality design flow rate for the contributing basin to this discharge location was evaluated to be 1.76 cfs. To sufficiently treat this flow rate, a vegetated swale was sized per the City's Standard Drawing 460. A swale with a bottom width, length, and longitudinal slope of 19 ft, 120 ft, and 0.5%, respectively, is proposed to treat the required flow rate (See Technical Appendix: Calculations).

A pretreatment manhole is proposed upstream of the Vegetated Swale. For this discharge location, the 25-yr peak flow is 7.33 cfs, resulting in a required sump volume of 146.6 cf. Assuming an 84" manhole diameter, the required depth is evaluated to be 45.7", which will be proposed at 48" to provide sufficient pretreatment.

WATER QUANTITY MANAGEMENT

Design Guidelines & Criteria

Per the D&C Standards, projects that generate a net impervious area of 2,877 sf (or greater) or disturbs an acre or more require Best Management Practices (BMP) to detain the stormwater runoff for all net new impervious area created. When required, the stormwater quantity onsite detention facilities shall be designed to capture runoff such that the post-development runoff rates do not exceed the predeveloped rates. Specifically, the 50% of the 2-, 2-, 10- and 25-yr post-development runoff rates will not exceed their respective 50% of 2-, 2-, 10- and 25-yr predeveloped rates. These criteria will be adhered to for Discharge Location #1.

Per ODOT Standards, detention facilities must be proposed to mitigate flooding and channel process (e.g., sediment transport). With regards to the size and outfall characteristics of the project, detention facilities must be designed such that the post-development runoff rates do not exceed the predeveloped runoff rates for the 42% of the 2-, 10-, 25- and 50-yr storm events. These criteria will be adhered to in conjunction to the flow criteria from the D&C Standards listed above for Discharge Location #2.

Detention Facilities

Discharge Location #1

A flow control manhole (FCMH) is proposed in-line with the storm drain system that outfalls to this discharge location. Runoff will be detained within the storm drain system and slowly released via orifices/weirs to match predeveloped flows. As Table 4 above indicates, flows will only need to be detained for the ½ of the 2-yr and 2-yr storm events due to the reduced contributing area. Details for the FCMH will be provided in the Final Stormwater Management Plan. Table 6 outlines the required release rates from the project site for Discharge Location #1.

Recurrence Interval (yr)	Required Release Rates (cfs)
50% of 2	0.02
2	0.16
10	0.59
25	0.86

Table 6 – Required Post-Developed Release Rates – Discharge Location #1

Discharge Location #2

A Detention Pond is proposed in the eastern portion of the project site to capture and detain runoff and will outfall to this discharge location. The proposed vegetated swale will be constructed at the bottom of the detention pond. Outflows from this facility will be released via an FCMH with orifices and weirs to match predeveloped runoff rates per Table 5. The facility has an estimated top area and total volume of 21,175 sf and 99,506 cf, respectively; these values take in consideration the required 1-ft of freeboard that must be provided during the 25-yr storm event. Details for the Detention Pond and FCMH will be provided in the Final Stormwater Management Plan. Table 7 outlines the required release rates from the project site for Discharge Location #2.

Recurrence Interval (yr)	Required Release Rates (cfs)
42% of 2	0.01
50% of 2	0.03
2	0.21
10	0.74
25	1.07
50	1.22

Table 7 – Required Post-Developed Release Rates – Discharge Location #2

HYDRAULIC ANALYSIS

In accordance with the D&C Standards, a backwater analysis will be performed to demonstrate that the hydraulic grade line shall in all cases be lower than a 2-ft minimum from finished grade at all structure locations. The results of the analysis will be provided in the Final Stormwater Management Plan.

DOWNSTREAM ANALYSIS

A stamped Certificate of Investigation is provided due to the proposed development constructing, collecting, and discharging more than 2,877 sf of new impervious area (See Technical Appendix: Certification of Investigation). The project is not expected to propose a fee in lieu, because post-developed runoff is currently planned to be managed by onsite detention facilities. As a result, a Downstream Analysis was not performed because the project is expected to match or reduce peak flows, thus mitigating downstream impacts.

OPERATIONS & MAINTENANCE

For privately maintained stormwater management facilities, a maintenance plan that clearly identifies maintenance activities and frequency in a form that can be easily provided to and understood by the people responsible for maintenance shall be prepared. An Operations & Maintenance (O&M) Plan will be prepared in conjunction with the Final Stormwater Management Plan. The O&M Plan will include the City Standard Private Facility Maintenance Agreement form and will be submitted to the City for review. Upon approval of the maintenance agreement by the City, the applicant shall record the agreement with Yamhill County and return one fully executed original to the City Recorders office.

CONCLUSIONS

This report demonstrates that the proposed stormwater management facilities for the Crestview Green Planned Unit Development will meet or exceed the requirements of the City of Newberg and ODOT. Water Quality Treatment will be addressed with a Proprietary Treatment System and Vegetated Swale. Water Quantity Management will be addressed with a Detention Pond and Flow Control Manholes.

TECHNICAL APPENDIX

Exhibits

- FIRMette
- Hydrologic Soil Group – Yamhill County
- Curve Numbers
- Existing Conditions
- Post-Developed Conditions

Calculations

- Time of Concentration
- Water Quality Swale

Hydrographs

- Predeveloped Runoff Hydrographs – Discharge Locations #1 & #2
- Post-Developed Runoff Hydrographs – Discharge Locations #1 & #2

Certification of Investigation

REFERENCES

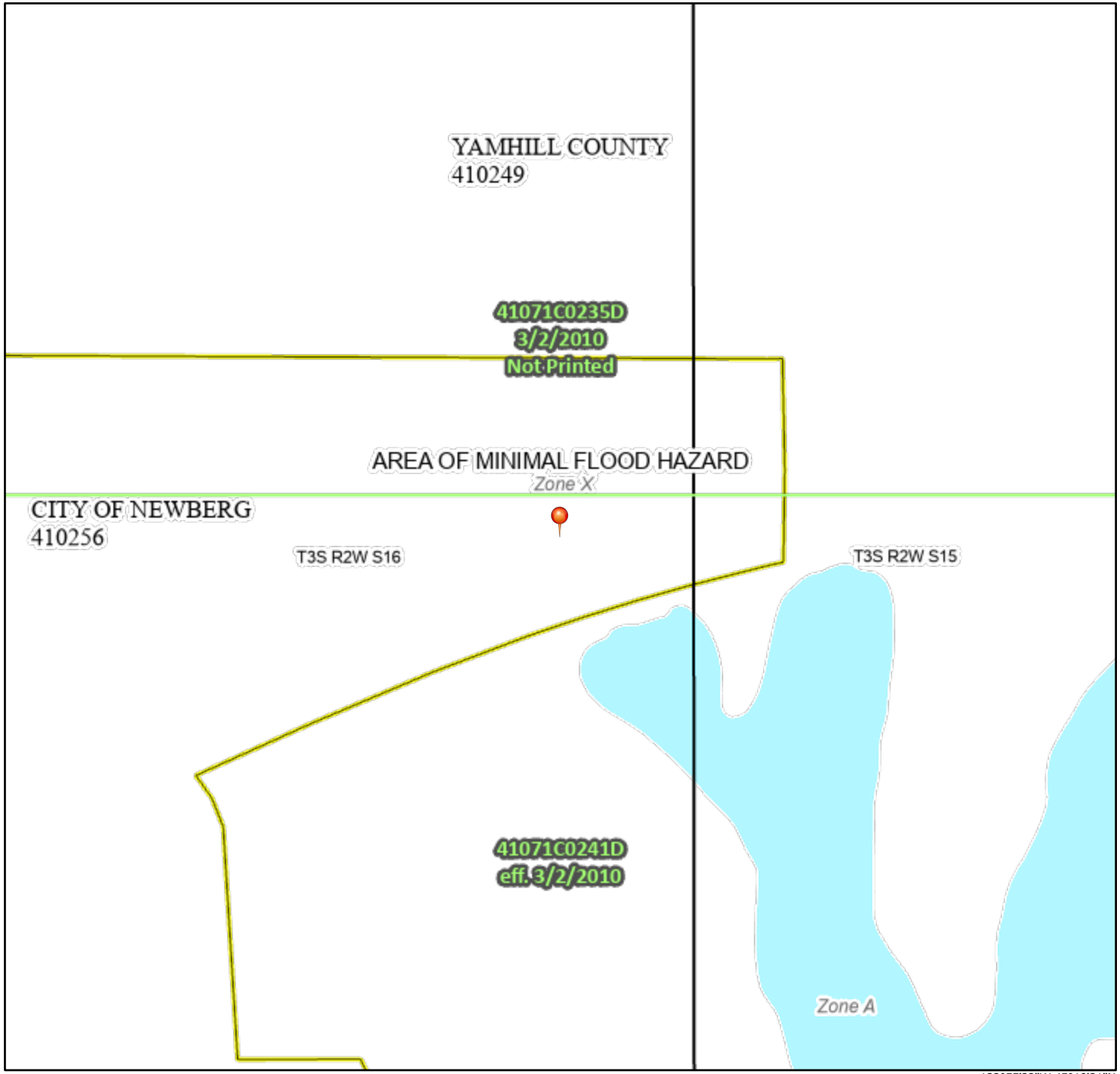
1. *Public Works Design & Construction Standards*. August 2015, City of Newberg
2. *Hydraulic Design Manual*. April 2014, Oregon Department of Transportation
3. *Urban Hydrology for Small Watersheds* (Technical Release 55). June 1986, U.S. Department of Agriculture

EXHIBITS

National Flood Hazard Layer FIRMette

FEMA

122°56'9"W 45°18'57"N



0 250 500 1,000 1,500 2,000 Feet

1:6,000

122°55'32"W 45°18'31"N

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 — Cross Sections with 1% Annual Chance
- 17.5 — Water Surface Elevation
- Coastal Transect
- 513 — Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

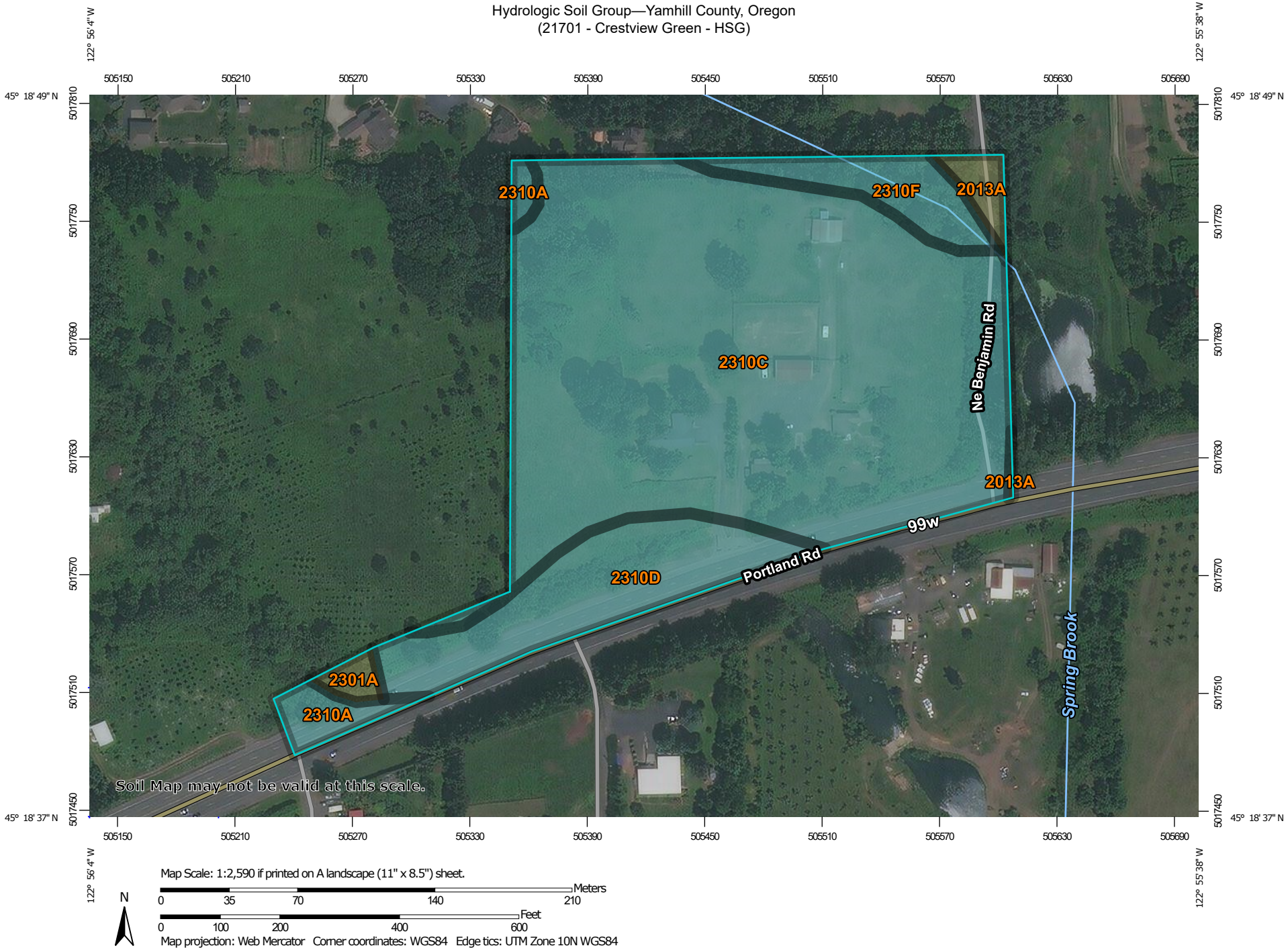
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 8/13/2021 at 9:09 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Hydrologic Soil Group—Yamhill County, Oregon
(21701 - Crestview Green - HSG)



Map Scale: 1:2,590 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Yamhill County, Oregon
Survey Area Data: Version 10, Oct 27, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 19, 2015—Sep 13, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
2013A	Wapato silty clay loam, 0 to 3 percent slopes	C/D	0.2	1.6%
2301A	Amity silt loam, 0 to 3 percent slopes	C/D	0.1	1.0%
2310A	Woodburn silt loam, 0 to 3 percent slopes	C	0.4	2.9%
2310C	Woodburn silt loam, 3 to 12 percent slopes	C	10.9	75.8%
2310D	Woodburn silt loam, 12 to 20 percent slopes	C	1.9	13.4%
2310F	Woodburn silt loam, 20 to 55 percent slopes	C	0.8	5.3%
Totals for Area of Interest			**14.4**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Table 2-2a Runoff curve numbers for urban areas [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area [2/]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3/]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4/]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5/]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

1 Average runoff condition, and $I_a = 0.2S$.

2 The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

3 CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

4 Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

5 Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 2-2c Runoff curve numbers for other agricultural lands [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. [2/]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. [3/]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 [4/]	48	65	73
Woods—grass combination (orchard or tree farm). [5/]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. [6/]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 [4/]	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

1 Average runoff condition, and $I_a = 0.2S$.

2 *Poor:* <50%) ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: > 75% ground cover and lightly or only occasionally grazed.

3 *Poor*: <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.

4 Actual curve number is less than 30; use CN = 30 for runoff computations.

5 CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.

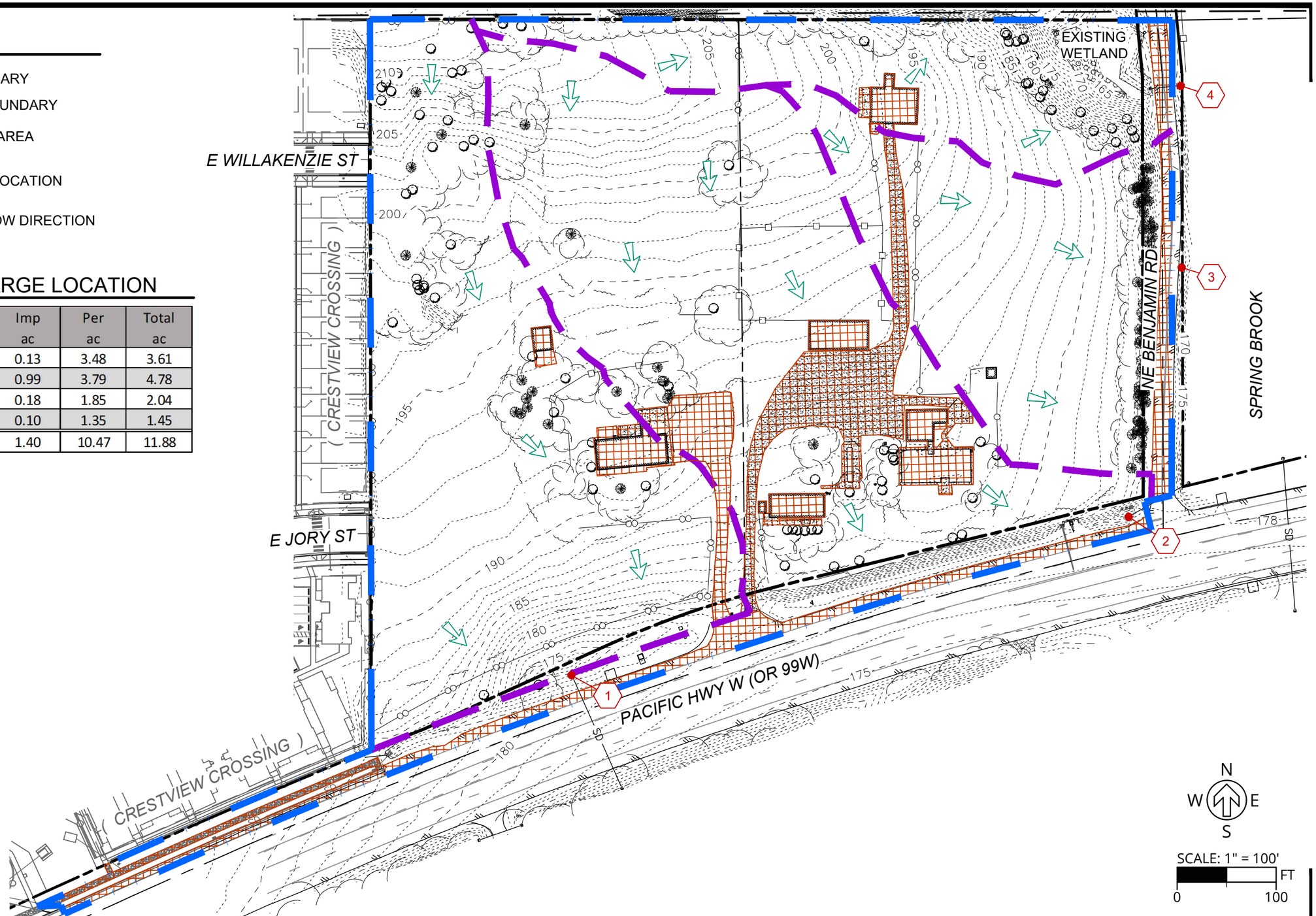
6 *Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

LEGEND

- BASIN BOUNDARY
- SUBBASIN BOUNDARY
- IMPERVIOUS AREA
- # DISCHARGE LOCATION
- SURFACE FLOW DIRECTION

BASIN AREAS PER DISCHARGE LOCATION

Discharge Location	Imp sf	Per sf	Total sf	Imp ac	Per ac	Total ac
#1	5,754	151,649	157,403	0.13	3.48	3.61
#2	43,035	164,970	208,005	0.99	3.79	4.78
#3	8,021	80,788	88,809	0.18	1.85	2.04
#4	4,322	58,823	63,145	0.10	1.35	1.45
Total	61,132	456,230	517,362	1.40	10.47	11.88



CRESTVIEW GREEN PLANNED UNIT DEVELOPMENT

WESTWOOD HOMES LLC

EXISTING CONDITIONS

JAN 2022

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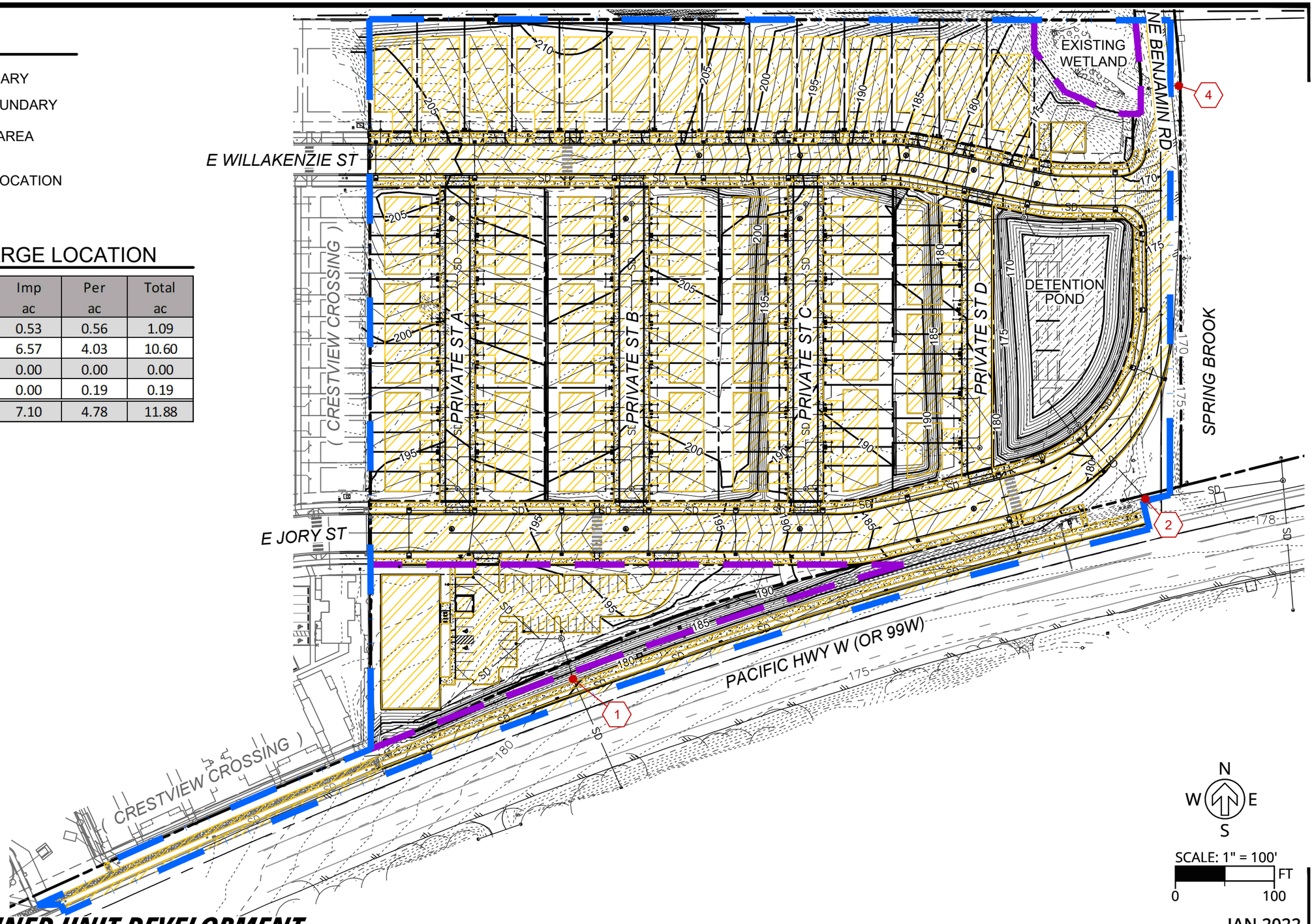
LEGEND

- BASIN BOUNDARY
- SUBBASIN BOUNDARY
- IMPERVIOUS AREA
- # DISCHARGE LOCATION

BASIN AREAS PER DISCHARGE LOCATION

Discharge Location	Imp sf	Per sf	Total sf	Imp ac	Per ac	Total ac
#1	22,969	24,429	47,398	0.53	0.56	1.09
#2	286,391	175,424	461,815	6.57	4.03	10.60
#3	0	0	0	0.00	0.00	0.00
#4	0	8,149	8,149	0.00	0.19	0.19
Total	309,360	208,002	517,362	7.10	4.78	11.88



N
W E
S

SCALE: 1" = 100'
0 100 FT

JAN 2022

CRESTVIEW GREEN PLANNED UNIT DEVELOPMENT

WESTWOOD HOMES LLC

POST-DEVELOPED CONDITIONS

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CALCULATIONS

PREDEVELOPED TIMES OF CONCENTRATION

PROJECT NO. 21701	BY PJP	DATE 1/14/2022

SHEET FLOW			
INPUT	**Discharge Location #1**	**Discharge Location #2**	
Surface Description	**Type 9 Woods (light_underbrush)**	**Type 9 Woods (light_underbrush)**	**Type #N/A**
Manning's "n"	**0.4**	**0.4**	**#N/A**
Flow Length, L	**100** ft	**100** ft	**0** ft
2-Yr 24 Hour Rainfall, P_2	**2.5** in	**2.5** in	**2.5** in
Land Slope, s	**0.071** ft/ft	**0.047** ft/ft	**0.0000** ft/ft
OUTPUT			
Travel Time	0.24 hr	0.29 hr	#N/A hr
SHALLOW CONCENTRATED FLOW			
INPUT	**VALUE**	**VALUE**	**VALUE**
Surface Description	**Unpaved**	**Unpaved**	**Unpaved**
Flow Length, L	**583** ft	**529** ft	**0** ft
Watercourse Slope*, s	**0.058** ft/ft	**0.048** ft/ft	**0** ft/ft
OUTPUT			
Average Velocity, V	3.89 ft/s	3.53 ft/s	0.00 ft/s
Travel Time	0.042 hr	0.042 hr	#DIV/0! hr
CHANNEL FLOW			
INPUT	**VALUE**	**VALUE**	**VALUE**
Cross Sectional Flow Area, a	**0** ft^2	**0** ft^2	**0** ft^2
Wetted Perimeter, P_w	**0** ft	**0** ft	**0** ft
Channel Slope, s	**0** ft/ft	**0** ft/ft	**0** ft/ft
Manning's "n"	**0.24**	**0.24**	**0.24**
Flow Length, L	**0** ft	**0** ft	**0** ft
OUTPUT			
Average Velocity	0.00 ft/s	0.00 ft/s	0.00 ft/s
Hydraulic Radius, r = a / P_w	1.00 ft	1.00 ft	1.00 ft
Travel Time	0.00 hr	0.00 hr	0.00 hr
Watershed or Subarea T_c =	**0.29 hr**	**0.33 hr**	**#N/A hr**
Watershed or Subarea T_c =	**17 minutes**	**20 minutes**	**#N/A minutes**

SWALE CALCULATIONS

SUBJECT	Crestview Green - Contributing Basin to Discharge Location #2		
PROJECT NO.	21701	**BY** PJP	**DATE** 1/14/2022

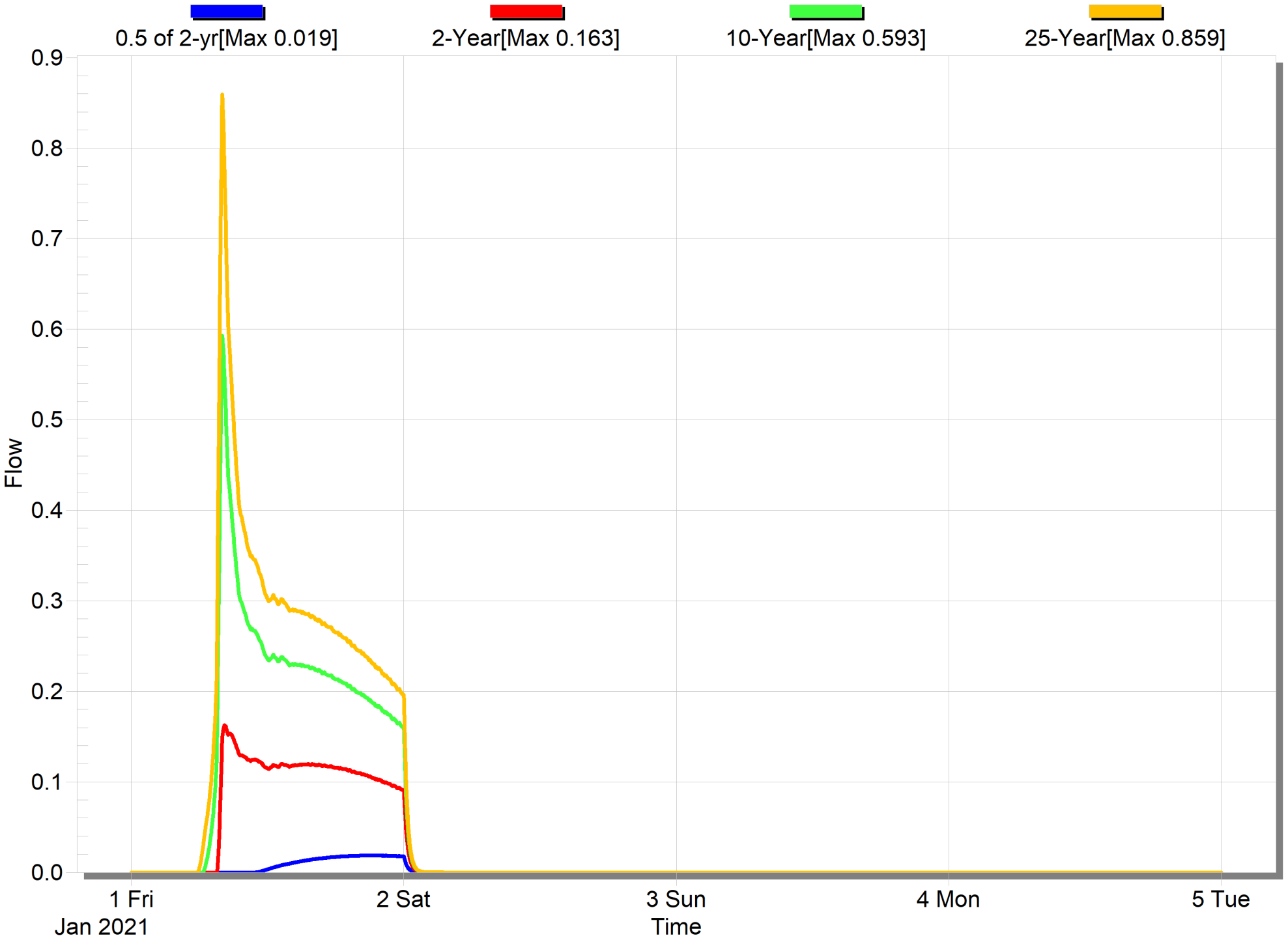
Swale Characteristics		
Input	**Description**	**Value**
Q	Peak design storm discharge	**1.76** cfs
n	Roughness factor	**0.24**
B	Swale width at base	**19.0** ft
Z	Side Slopes X:1	**4** H:1V
s	Slope of channel (ft/ft, 0.005 minimum)	**0.005** ft/ft
t	Minimum hydraulic residence time	**9** min

Flow Results (Q)		
Input	**Description**	**Value**
Y	Normal depth (Max depth = 0.50 ft)	**0.39** ft
P	Wetted perimeter	**22.19** ft
A	Cross section flow area	**7.95** ft^2
R	Hydraulic radius	**0.36** ft
W	Width of water surface in Swale	**22.09** ft
V	Velocity	**0.22** ft/s
L	Length (Minimum length = 100 ft)	**119.6** ft

HYDROGRAPHS

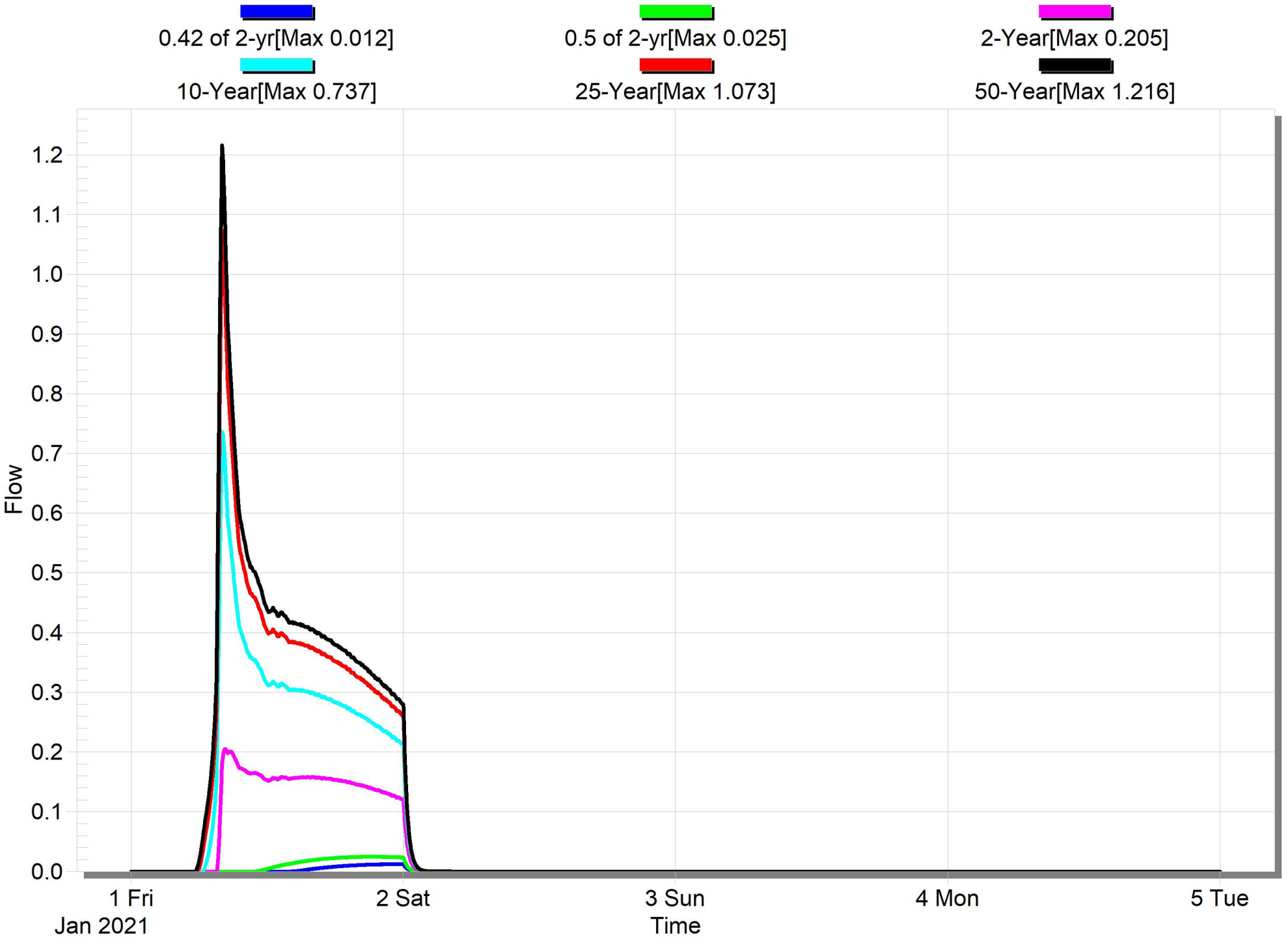
Predeveloped Runoff Hydrographs (cfs)

Discharge Location #1



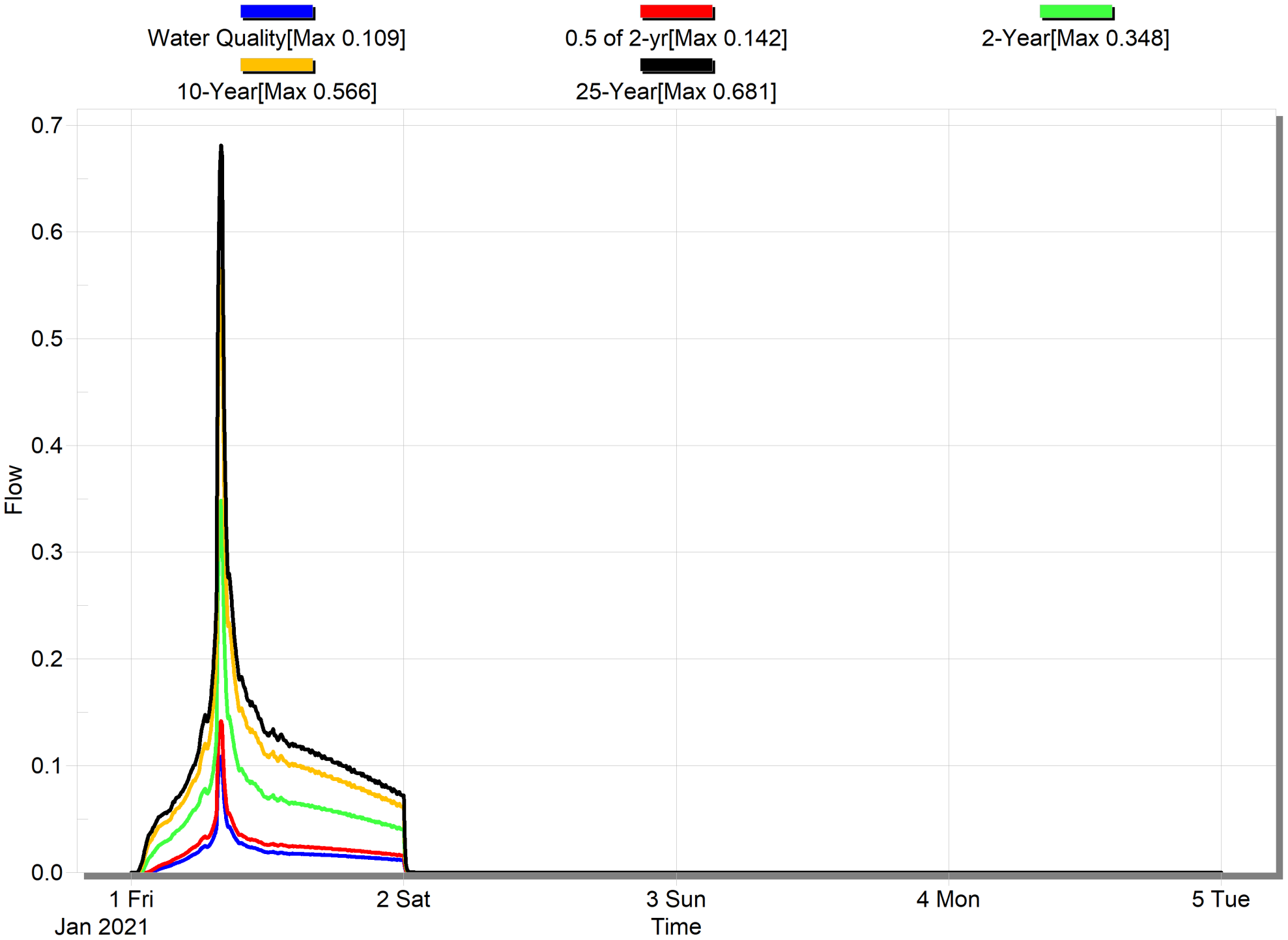
Predeveloped Runoff Hydrographs (cfs)

Discharge Location #2



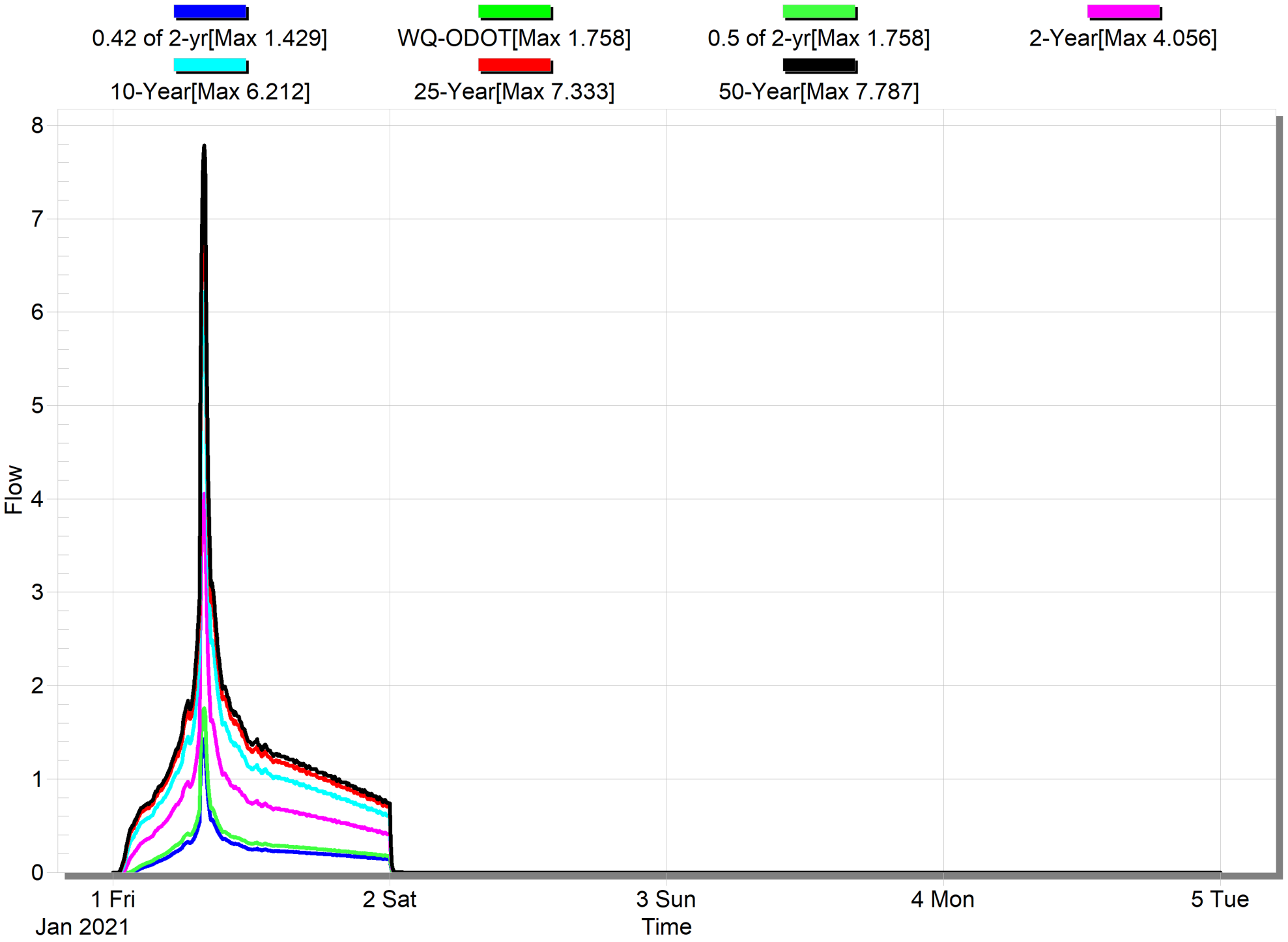
Post-Developed Runoff Hydrographs (cfs)

Discharge Location #1



Post-Developed Runoff Hydrographs (cfs)

Discharge Location #2



CERTIFICATION OF INVESTIGATION

CERTIFICATION OF INVESTIGATION

Per Section 4.5.IV(c) of the City's Design Standards, a Certificate of Investigation is required when a downstream analysis has not been conducted for at least one-quarter mile stating the downstream system has been visually investigated and no observable downstream impacts to structures were observed.

Although the entire stretch of one-quarter mile was not physically walked (due to private property restrictions), aerial photographs were obtained comparing August 2013 (pre-City of Newberg Stormwater Master Plan) and August 2018 (most current available from Google Earth) that show a very wide-open space for water to drain through. There were no observable changes or obstructions in the downstream system.

It is proposed that the existing downstream system will continue to have capacity to convey the detained, post-developed flow from the proposed Crestview Green Planned Unit Development.

Kathleen Freeman, PE, CFM
Water Resources Project Manager

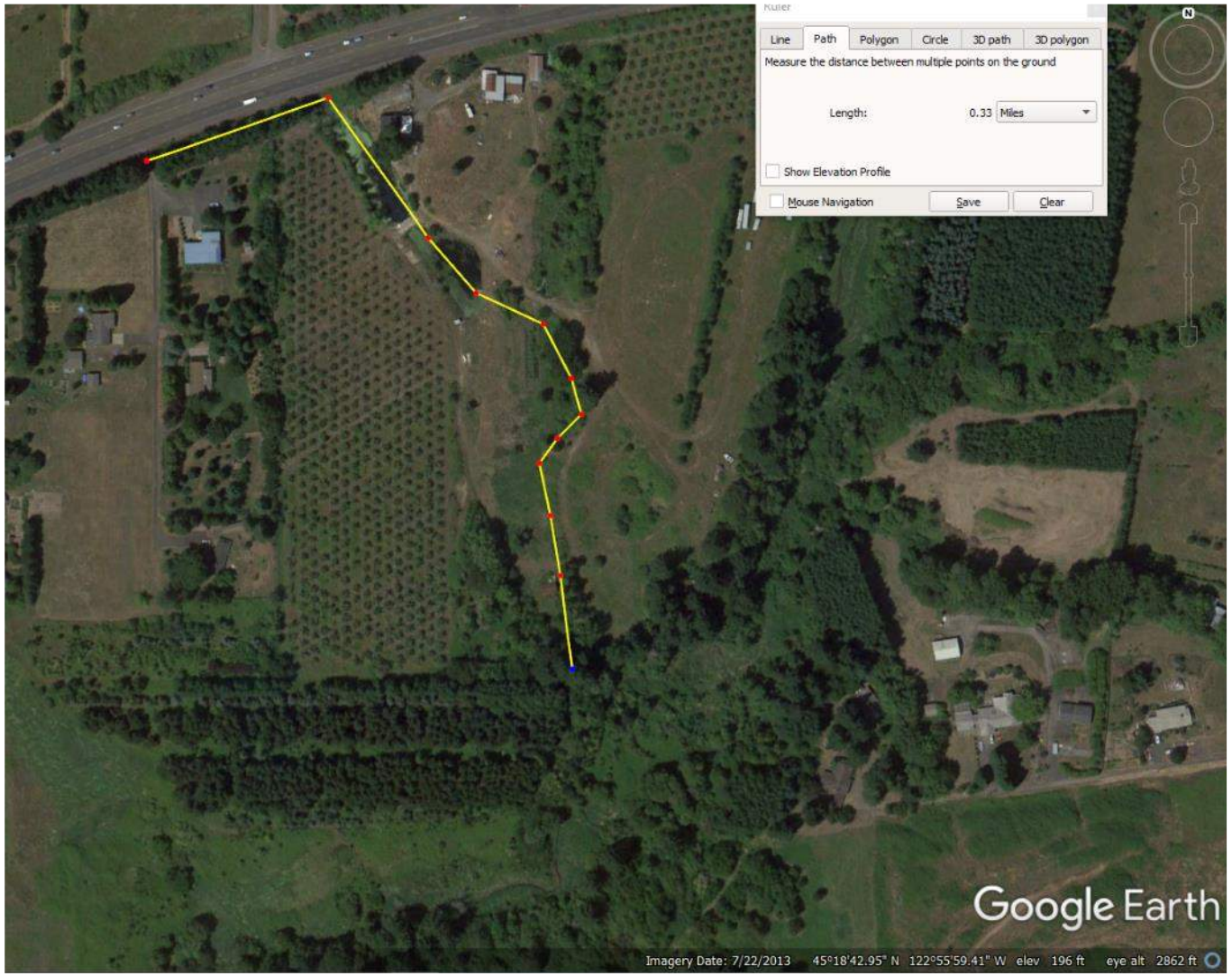


Photo 1: Aerial of downstream system approximately 0.33 miles downstream of Discharge Locations #1 & 2. Image taken **7/22/2013** at 2,862 ft above ground surface.

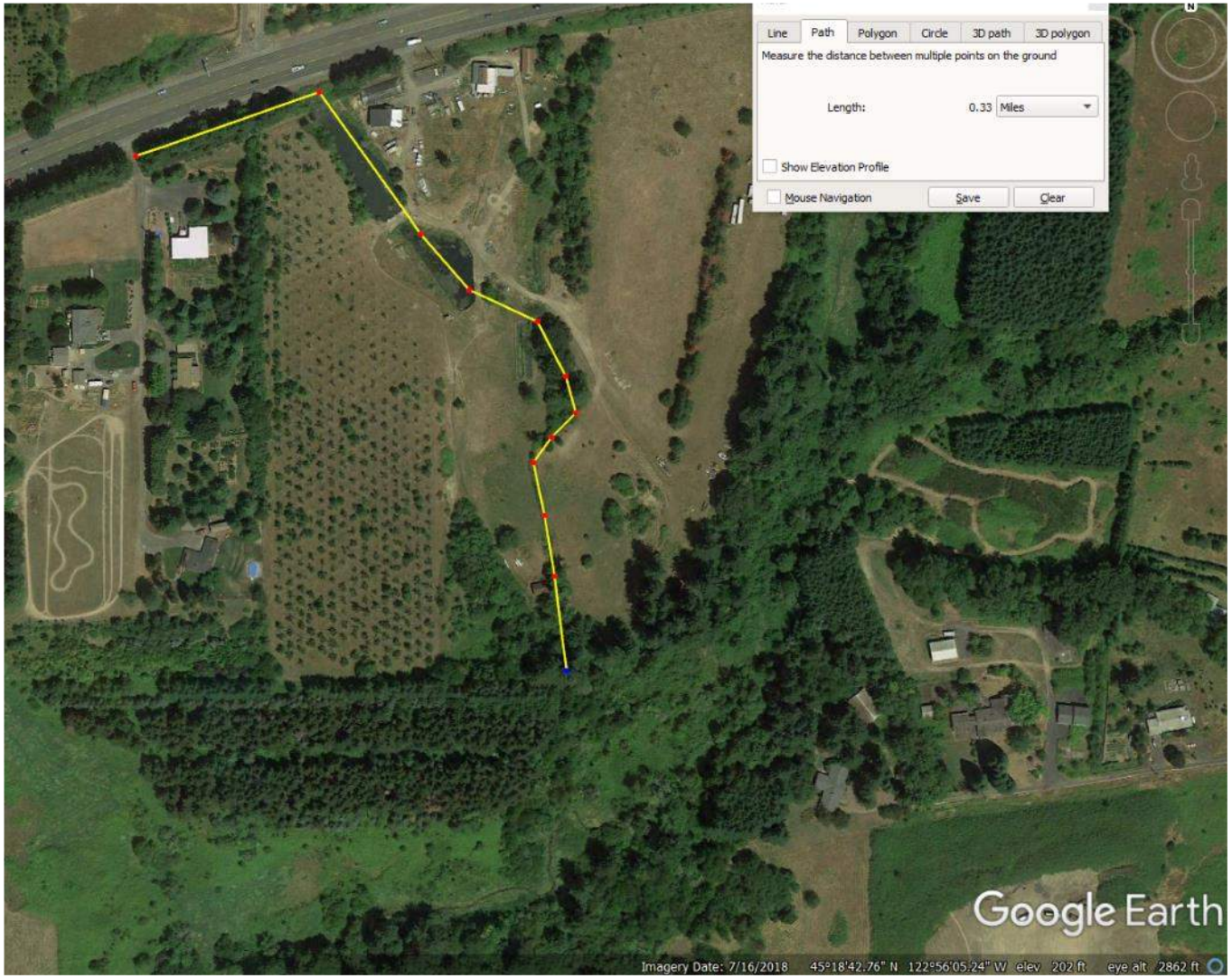


Photo 2: Aerial of downstream system approximately 0.33 miles downstream of discharge locations. Image taken **7/16/2018** at 2,862 ft above ground surface.

Photo 3: Image taken **7/22/2013** at 948 ft above ground surface.

Photo 4: Image taken **7/16/2018** at 948 ft above ground surface.

Photo 5: Image taken **7/22/2013** at 948 ft above ground surface.

Photo 6: Image taken **7/16/2018** at 948 ft above ground surface.

Photo 7: Image taken **7/22/2013** at 948 ft above ground surface.

Photo 8: Image taken **7/16/2018** at 948 ft above ground surface.